

Hude
A10

WHAT IS CLAIMED IS:

1. A laser oscillation apparatus comprising wavelength change means for driving a wavelength selection element and changing an oscillation wavelength of a laser beam to a target value,
wherein said wavelength change means calculates a driving amount of the wavelength selection element on the basis of the target value, drives the wavelength selection element on the basis of the calculated driving amount of the wavelength selection element, and changes the oscillation wavelength of the laser beam to the target value.
2. The apparatus according to claim 1, wherein the apparatus further comprises oscillation history memory means for storing an oscillation state of the laser beam as an oscillation history, and
said wavelength change means calculates the driving amount of the wavelength selection element on the basis of the oscillation history, drives the wavelength selection element on the basis of the calculated driving amount of the wavelength selection element, and changes the oscillation wavelength of the laser beam to the target value.
3. The apparatus according to claim 2, wherein the oscillation history includes at least one of an oscillation wavelength change amount of the laser beam, an oscillation idle time of the laser beam, and an

oscillation duty.

4. The apparatus according to claim 1, wherein thresholds are set for the oscillation wavelength change amount of the laser beam and the oscillation idle time of the laser beam, whether the oscillation wavelength change amount of the laser beam or the oscillation idle time of the laser beam exceeds the threshold is determined, and a wavelength lock signal is output based on a determination result.
5. The apparatus according to claim 4, wherein a shutter is closed when the oscillation wavelength change amount of the laser beam or the oscillation idle time of the laser beam exceeds the threshold.
- 10 6. The apparatus according to claim 1, further comprising wavelength measurement means for measuring the oscillation wavelength of the laser beam.
- 15 7. The apparatus according to claim 6, wherein the apparatus further comprises internal environment measurement means for measuring an internal environment of said wavelength measurement means, and said wavelength measurement means is corrected based on the measured internal environment of said wavelength measurement means.
- 20 8. The apparatus according to claim 7, wherein the internal environment of said wavelength measurement means includes at least one of a temperature and atmospheric pressure.
- 25

A10
Cont'd

9. The apparatus according to claim 6, wherein whether the measured oscillation wavelength of the laser beam falls within a predetermined allowable range is determined, and a wavelength lock signal is output based
5 on a determination result.

10. The apparatus according to claim 9, wherein output of the laser beam is stopped when the oscillation wavelength of the laser beam does not fall within the predetermined allowable range.
QD cont'd

10 11. The apparatus according to claim 1, wherein output of the laser beam is not stopped in changing the oscillation wavelength of the laser beam.

12. The apparatus according to claim 1, wherein no test laser beam is emitted in changing the oscillation
15 wavelength of the laser beam.

13. The apparatus according to claim 1, wherein the wavelength selection element includes one of a grating and etalon.

14. The apparatus according to claim 1, wherein the
20 laser beam includes an excimer laser beam.

15. An exposure apparatus using a laser oscillation apparatus as a light source, wherein
the laser oscillation apparatus comprises
wavelength change means for driving a wavelength
25 selection element and changing an oscillation wavelength
of a laser beam to a target value, and
said wavelength change means calculates a driving

amount of the wavelength selection element on the basis of the target value, drives the wavelength selection element on the basis of the calculated driving amount of the wavelength selection element, and changes the

- 5 oscillation wavelength of the laser beam to the target value.

16. The apparatus according to claim 15, wherein the oscillation wavelength of the laser beam is changed between end of exposure in a predetermined exposure 10 region on a substrate to be exposed and start of exposure in a next exposure region.

17. A semiconductor device manufacturing method of manufacturing a semiconductor device by using an exposure apparatus, comprising the steps of:

- 15 applying a resist to a substrate;
drawing a pattern on the substrate by using the exposure apparatus; and

- developing the substrate,
wherein the exposure apparatus uses as a light 20 source a laser oscillation apparatus having wavelength change means for driving a wavelength selection element and changing an oscillation wavelength of a laser beam to a target value, and

- the wavelength change means calculates a driving 25 amount of the wavelength selection element on the basis of the target value, drives the wavelength selection element on the basis of the calculated driving amount of

10
confid

the wavelength selection element, and changes the oscillation wavelength of the laser beam to the target value.

18. A semiconductor device manufacturing method comprising the steps of:

installing manufacturing apparatuses for various processes including an exposure apparatus in a semiconductor manufacturing factory; and

manufacturing a semiconductor device by using the manufacturing apparatuses in a plurality of processes, wherein the exposure apparatus uses as a light source a laser oscillation apparatus having wavelength change means for driving a wavelength selection element and changing an oscillation wavelength of a laser beam to a target value, and

the wavelength change means calculates a driving amount of the wavelength selection element on the basis of the target value, drives the wavelength selection element on the basis of the calculated driving amount of the wavelength selection element, and changes the oscillation wavelength of the laser beam to the target value.

19. The method according to claim 18, further comprising the steps of:

connecting the manufacturing apparatuses by a local area network; and

communicating information about at least one of

the manufacturing apparatuses between the local area network and an external network outside the semiconductor manufacturing factory.

20. The method according to claim 19, wherein a
5 database provided by a vendor or user of the exposure apparatus is accessed via the external network to obtain maintenance information of the manufacturing apparatus by data communication, or production management is performed by data communication between the
10 semiconductor manufacturing factory and another semiconductor manufacturing factory via the external network.
21. A semiconductor manufacturing factory comprising:
manufacturing apparatuses for various processes
15 including an exposure apparatus;
a local area network for connecting said manufacturing apparatuses; and
a gateway which allows the local area network to access an external network outside the factory,
20 wherein information about at least one of said manufacturing apparatuses can be communicated,
said exposure apparatus uses as a light source a laser oscillation apparatus having wavelength change means for driving a wavelength selection element and
25 changing an oscillation wavelength of a laser beam to a target value, and
said wavelength change means calculates a driving

- amount of the wavelength selection element on the basis
of the target value, drives the wavelength selection
element on the basis of the calculated driving amount of
the wavelength selection element, and changes the
5 oscillation wavelength of the laser beam to the target
value.
22. A maintenance method for an exposure apparatus
installed in a semiconductor manufacturing factory,
comprising the steps of:
- 10 causing a vendor or user of the exposure apparatus
to provide a maintenance database connected to an
external network of the semiconductor manufacturing
factory;
- 15 authorizing access from the semiconductor
manufacturing factory to the maintenance database via
the external network; and
- transmitting maintenance information accumulated
in the maintenance database to the semiconductor
manufacturing factory via the external network,
- 20 wherein the exposure apparatus uses as a light
source a laser oscillation apparatus having wavelength
change means for driving a wavelength selection element
and changing an oscillation wavelength of a laser beam
to a target value, and
- 25 the wavelength change means calculates a driving
amount of the wavelength selection element on the basis
of the target value, drives the wavelength selection

element on the basis of the calculated driving amount of the wavelength selection element, and changes the oscillation wavelength of the laser beam to the target value.

- 10 23. The apparatus according to claim 15, wherein
 the exposure apparatus further comprises a display,
 a network interface, and a computer for executing
 network software, and
 maintenance information of the exposure apparatus
10 can be communicated via the computer network.
24. The apparatus according to claim 23, characterized
 in that the network software is connected to an external
 network of a factory where the exposure apparatus is
 installed, provides on said display a user interface for
15 accessing a maintenance database provided by a vendor or
 user of the exposure apparatus, and enables obtaining
 information from the database via the external network.